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**Intermountain
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Ogden, UT 84401**

Research
Note INT-352

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A Computer Software System for Entering, Managing, and Analyzing Fish Capture Data from Streams

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ABSTRACT

A microcomputer software system called the "Fisheries Population and Statistical Package" (FPSP) is intended for use in entering, managing, and analyzing fish capture data from streams. The system, written in the BASIC language, facilitates data entry with prompts and editing during input. Once entered, data can be further organized with enhanced editing allowing for additions, deletions, and modifications of observations. The data sets created may be copied, printed, or displayed on the computer terminal. Data analysis is the main feature of FPSP. Nineteen categories of calculations are performed including total catch, maximum-likelihood population estimates, capture probabilities, lengths, and weights. FPSP allows multiple study sites to be compared simultaneously for study purposes. An example of FPSP system output is provided. The BASIC code for an abbreviated, interactive version of FPSP is included, along with an example of printed output.

KEYWORDS: fisheries, data analysis, computer software, electrofishing, microcomputer, population estimation

The Fisheries Population and Statistical Package (FPSP) consists of four software programs developed in the BASIC language for the IBM personal computer. The purpose of FPSP is to provide quick and accurate entry, management, and analysis of fish capture data gathered by a removal-depletion electrofishing effort. Computer automation of this process reduces the chance of transcription errors, facilitates data editing, and eliminates the tedium and possible human error in statistical analysis. FPSP provides a variety of calculations and data comparison options that enhance the researcher's perspective regarding the significance of the data. In short, the time, effort, and money that previously had been spent processing results may now be invested interpreting the results.

SYSTEM CAPABILITIES

The three main performance capabilities of FPSP are data entry, data management, and data analysis.

Data Entry

Fish capture data can be entered directly into the computer using FPSP's Data Management Program. This program prompts the user to assign a file name to the data set and then asks the user to input essential data (removal number, species number, length, and weight) for each fish collected. Editing statements are included to detect and correct invalid entries.

Data Management

Following the initial data input, the user may select an option from a menu to:

1. Modify observations
2. Add or delete observations
3. Print or display formatted data
4. Create new data sets
5. Copy existing data sets.

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Data Analysis

Most of the FPSP system is dedicated to data analysis. FPSP allows the user to define multiple "study sites" within a "study area." A stream, for example, might be divided into three segments, which together are the study area. Data analysis is performed both by study site and by study area for the purpose of comparison.

The following calculations are performed for (a) individual species within each study site, (b) individual species in the study area, (c) the total of all species within each study site, and (d) the total of all species in the study area:

1. Total catch
2. Total catch percentages
3. Maximum-likelihood population estimates
4. Population estimate percentages
5. Population estimate standard errors
6. Population estimate 95 percent confidence intervals
7. Capture probabilities
8. Capture probability standard errors
9. Capture probability 95 percent confidence intervals
10. Chi-square goodness of fit on the maximum-likelihood estimates
11. Condition factors
12. Average lengths
13. Length standard errors
14. Length 95 percent confidence intervals
15. Total weights
16. Total weight percentages
17. Average weights
18. Weight standard errors
19. Weight 95 percent confidence intervals.

See appendix A for an example of FPSP's output.

SPECIAL FEATURES

Five special features are included in the FPSP system.

Maximum-Likelihood Estimation

Computer automation of the data analysis has made it possible to incorporate the use of a sophisticated maximum-likelihood population estimate model developed by Dr. Kenneth P. Burnham of North Carolina State University (Van Deventer and Platts 1983). This method provides accurate population estimates by calculating the likelihood of every possible population estimate equal to or greater than the total catch until the estimate of greatest likelihood is reached. The number of calculations involved makes this iterative process impractical with a hand calculator. The maximum-likelihood estimate is applicable to fish capture data involving two or more electrofishing removals. Generally, the more removals, the narrower the confidence intervals are around the population estimate.

Calculation Speed and Accuracy

Calculation time is minimized with FPSP because no manual computations are required; hence, program calculations should also be highly accurate. On an average-sized data set FPSP will perform approximately 21,500 calculations in a little over 2 minutes.

Comparisons Between Study Sites

The ability to compare study sites is an important feature of FPSP. Because the user defines what constitutes a study site, a variety of research options are available. For example, different streams in the same watershed can be compared with one another. The same stream may be compared with itself from one year to the next for time-trend analysis. Or suppose we defined three adjacent sites on a stream—a treatment site surrounded by two control sites—all of equal stream length. FPSP has the ability to compare the numbers of fish in each site. Furthermore, if habitat deterioration is suspected in the treatment site, comparisons can be made to assess species composition, fish weights, and condition factors.

System Adaptability

FPSP was designed to accommodate the widest possible range of experimental conditions.

1. FPSP manages one or more study sites per study area. (Note: Although FPSP performs calculations on any number of study sites, only three sites will be printed on 80-column paper and six sites on 132-column paper.)

2. FPSP performs calculations individually and corporately for any number of species encountered.

3. FPSP accommodates special data-handling needs. For example, it may not be desirable to measure the length and weight of nongame fish individually. In such cases the option exists to enter the total number of nongame fish and the total weight as a single observation. A special "species file" allows the user to distinguish between game and nongame fish.

4. FPSP allows the user to select the calculations that are to be printed from an output menu.

An Interactive Version of FPSP

For those desiring immediate population results, the FPSP Interactive Program is available (see appendix B). This program prompts the user for stream name, species name, the number of removals, and the number of fish caught on each removal. The output includes total catch, maximum-likelihood population estimate, capture probability, chi-square, and standard errors and confidence intervals for both the population estimate and the capture probability (see appendix C). The length and weight data are not considered in this abbreviated program.

TECHNICAL CONSIDERATIONS

Maximum-likelihood population estimates based on a removal-depletion strategy assume (Zippin 1958):

1. No animals enter or leave the study area.
2. Each individual has an equal chance of being captured.
3. The probability of capture remains the constant with each removal.

The maximum-likelihood estimate and those statistics associated with it are detrimentally impacted by a lack of adherence to these assumptions. The chi-square test, the confidence intervals around the population estimate, and the capture probability are indicators of how well these assumptions have been met. If there is an abnormally low capture probability, a highly variable capture probability, or a nondescending removal pattern, the maximum-likelihood calculation will terminate at five times the total catch and a warning message will be displayed.

FPSP does not require an entire study site to be electrofished at one time. For example, a 100-m length of stream may be broken into five 20-m segments to facilitate electrofishing.

FPSP was written for an IBM Personal Computer XT using Disk Operating System (DOS) Version 2.1. It will presumably work on an IBM PC, an IBM PC AT, or an IBM PC-compatible computer with DOS 2.0, DOS 2.1, or DOS 3.0. FPSP requires a minimum of 256 kilobytes (K) of random access memory (RAM). Large data sets may require more memory.

REFERENCES

Van Deventer, J. S.; Platts, W. S. Sampling and estimating fish populations from streams. Transactions of the North American Wildlife and Natural Resources Conference. 48: 349-354; 1983.

Zippin, C. The removal method of population estimation. Journal of Wildlife Management. 22(1): 82-90; 1958.

APPENDIX A: EXAMPLE OF OUTPUT FROM FPSP SYSTEM

```
==============================================================================
FISH SAMPLING RESULTS
TITLE:   South Fork Salmon R. 10/15/84      Number of Sites    =  3
FILE:    FISH.DAT                           Number of Removals =  4
DATE:    11-04-84     7:11 p.m.             Number of Species  =  3
==============================================================================


                         FISH CAPTURE TOTALS (% by Species)
SPECIES                SITE = 1       SITE = 2       SITE = 3          TOTAL
------------------------------------------------------------------------------
                | #FISH    %  | #FISH    %  | #FISH    %  || #FISH    %
------------------------------------------------------------------------------
                |             |             |             ||
Rainbow Trout   |  169   42.0%|   72   17.9%|  161   40.0%||  402  100.0%
Cutthroat Trout |   44   34.1%|   20   15.5%|   65   50.4%||  129  100.0%
Sucker          |   18   10.6%|  133   78.2%|   19   11.2%||  170  100.0%
                |             |             |             ||
------------------------------------------------------------------------------
TOTAL           |  231   33.0%|  225   32.1%|  245   35.0%||  701  100.0%
------------------------------------------------------------------------------


                          FISH CAPTURE TOTALS (% by Site)
SPECIES                SITE = 1       SITE = 2       SITE = 3          TOTAL
------------------------------------------------------------------------------
                | #FISH    %  | #FISH    %  | #FISH    %  || #FISH    %
------------------------------------------------------------------------------
                |             |             |             ||
Rainbow Trout   |  169   73.2%|   72   32.0%|  161   65.7%||  402   57.3%
Cutthroat Trout |   44   19.0%|   20    8.9%|   65   26.5%||  129   18.4%
Sucker          |   18    7.8%|  133   59.1%|   19    7.8%||  170   24.3%
                |             |             |             ||
------------------------------------------------------------------------------
TOTAL           |  231  100.0%|  225  100.0%|  245  100.0%||  701  100.0%
------------------------------------------------------------------------------


                        POPULATION ESTIMATES (% by Species)
SPECIES                SITE = 1       SITE = 2       SITE = 3          TOTAL
------------------------------------------------------------------------------
                |  EST     %  |  EST     %  |  EST     %  || TOTAL  %    EST
------------------------------------------------------------------------------
                |             |             |             ||
Rainbow Trout   |  175   41.9%|   75   17.9%|  168   40.2%||  418 100%   420
Cutthroat Trout |   45   33.8%|   21   15.8%|   67   50.4%||  133 100%   135
Sucker          |   18   10.1%|  142   79.3%|   19   10.6%||  179 100%   180
                |             |             |             ||
------------------------------------------------------------------------------
SITE ESTIMATES  |  239   32.5%|  240   32.7%|  256   34.8%||  737 100%   735
------------------------------------------------------------------------------
```

(con.)

POPULATION ESTIMATES (% by Site)

SPECIES	SITE = 1		SITE = 2		SITE = 3		TOTAL	
	EST	%	EST	%	EST	%	EST	%
Rainbow Trout	175	73.5%	75	31.5%	168	66.1%	420	57.1%
Cutthroat Trout	45	18.9%	21	8.8%	67	26.4%	135	18.4%
Sucker	18	7.6%	142	59.7%	19	7.5%	180	24.5%
ESTIMATE TOTALS	238	100.0%	238	100.0%	254	100.0%	735	100.0%
SITE ESTIMATES	239		240		256		735	

POPULATION ESTIMATE STANDARD ERRORS

SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	3.524	2.691	3.953	6.161
Cutthroat Trout	1.518	1.946	2.264	3.658
Sucker	0.879	4.909	0.829	5.034
SITE STD ERROR	4.067	6.220	4.899	8.889

POPULATION ESTIMATE 95% CONFIDENCE INTERVALS

SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	169, 182	72, 80	161, 176	408, 432
Cutthroat Trout	44, 48	20, 25	65, 72	129, 142
Sucker	18, 20	133, 152	19, 21	170, 190
SITE ESTIMATES	231, 247	228, 252	246, 266	720, 754

CAPTURE PROBABILITIES

SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	0.5615	0.5373	0.5403	0.5425
Cutthroat Trout	0.5867	0.4878	0.5556	0.5353
Sucker	0.6000	0.4926	0.6129	0.5075
SITE TOTAL	0.5634	0.4967	0.5396	0.5291

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CAPTURE PROBABILITY STANDARD ERROR

SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	0.0389	0.0613	0.0408	0.0257
Cutthroat Trout	0.0745	0.1233	0.0634	0.0458
Sucker	0.1158	0.0471	0.1110	0.0411
SITE CAPT S.E.	0.0332	0.0361	0.0331	0.0197

CAPTURE PROBABILITY 95% CONFIDENCE INTERVALS

SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	0.4848, 0.6382	0.4153, 0.6593	0.4599, 0.6206	0.4918, 0.5932
Cutthroat Trout	0.4367, 0.7366	0.2313, 0.7443	0.4291, 0.6820	0.4446, 0.6259
Sucker	0.3566, 0.8434	0.3993, 0.5859	0.3805, 0.8453	0.4266, 0.5883
SITE 95% C.I.	0.4979, 0.6289	0.4257, 0.5677	0.4745, 0.6048	0.4904, 0.5678

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SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	0.2341	2.1172	0.1651	0.3148
Cutthroat Trout	2.2675	0.3464	0.3552	1.1650
Sucker	0.3592	0.0895	0.2925	0.1125
SITE TOTAL	0.1792	0.5107	0.2924	0.8080

CONDITION FACTORS

SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	1.108	1.100	1.054	1.085
Cutthroat Trout	1.122	1.173	1.109	1.123
Sucker	1.086	1.089	1.071	1.087

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AVERAGE LENGTHS

SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	101.0	92.5	108.6	102.5
Cutthroat Trout	90.9	74.8	89.8	87.9
Sucker	92.5	102.7	98.6	101.2

LENGTH STANDARD ERRORS

SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	2.965	4.375	2.492	1.798
Cutthroat Trout	5.501	8.099	3.927	3.018
Sucker	4.855	2.973	5.523	2.465

LENGTH 95% CONFIDENCE INTERVALS

SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	95.1, 106.8	83.8, 101.2	103.7, 113.6	99.0, 106.1
Cutthroat Trout	79.8, 102.0	57.8, 91.7	82.0, 97.7	81.9, 93.8
Sucker	82.3, 102.7	96.9, 108.6	87.0, 110.2	96.3, 106.1

TOTAL WEIGHTS (% by Species)

SPECIES	SITE = 1		SITE = 2		SITE = 3		TOTAL	
	WEIGHT	%	WEIGHT	%	WEIGHT	%	WEIGHT	%
Rainbow Trout	2622	43.2%	887	14.6%	2558	42.2%	6067	100.0%
Cutthroat Trout	515	37.8%	155	11.4%	694	50.9%	1364	100.0%
Sucker	167	7.1%	1964	83.5%	221	9.4%	2352	100.0%
TOTAL	3304	33.8%	3006	30.7%	3473	35.5%	9783	100.0%

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APPENDIX A: (Con.)

TOTAL WEIGHTS (% by Site)

SPECIES	SITE = 1		SITE = 2		SITE = 3		TOTAL	
	WEIGHT	%	WEIGHT	%	WEIGHT	%	WEIGHT	%
Rainbow Trout	2622	79.4%	887	29.5%	2558	73.7%	6067	62.0%
Cutthroat Trout	515	15.6%	155	5.2%	694	20.0%	1364	13.9%
Sucker	167	5.1%	1964	65.3%	221	6.4%	2352	24.0%
TOTAL	3304	100.0%	3006	100.0%	3473	100.0%	9783	100.0%

AVERAGE WEIGHTS

SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	15.5	12.3	15.9	15.1
Cutthroat Trout	11.7	7.8	10.7	10.6
Sucker	9.3	14.8	11.6	13.8

WEIGHT STANDARD ERRORS

SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	1.295	1.692	0.869	0.715
Cutthroat Trout	1.964	2.581	1.687	1.151
Sucker	1.182	1.188	1.614	0.964

WEIGHT 95% CONFIDENCE INTERVALS

SPECIES	SITE = 1	SITE = 2	SITE = 3	TOTAL
Rainbow Trout	13.0, 18.1	8.9, 15.7	14.2, 17.6	13.7, 16.5
Cutthroat Trout	7.7, 15.7	2.3, 13.2	7.3, 14.0	8.3, 12.9
Sucker	6.8, 11.8	12.4, 17.1	8.2, 15.0	11.9, 15.7

APPENDIX B: BASIC LANGUAGE INSTRUCTIONS FOR THE FPSP INTERACTIVE VERSION

```
1000 REM           FISHERIES POPULATION and STATISTICAL PACKAGE
1010 REM
1020 REM               POPULATION ESTIMATE PROGRAM (FPSP-3)
1030 REM                       Interactive  Version
1040 REM
1050 REM  Permission to copy this program is granted under the condition that
1060 REM  NO alterations be made (to prevent distribution of unauthorized
1070 REM  or erroneous modifications, or both).
1080 REM
1090 REM  Please contact the author
1100 REM      (1) to be kept informed of enhancements or modifications to
1110 REM              this program
1120 REM      (2) to provide any comments (positive or negative)
1130 REM      (3) if any program-related problems occur
1140 REM
1150 REM  This program has been thoroughly tested and is accurate to the
1160 REM  best of my knowledge.
1170 REM
1180 REM                    John S. Van Deventer
1190 REM                    USDA  Forest Service
1200 REM                    Forestry Science Lab
1210 REM                    316 E. Myrtle Street
1220 REM                    Boise, ID  83702
1230 REM
1240 REM ======================================================================
1250 CLS
1260 REM ______________________________________________________________________
1270 REM  Title page.
1280 REM ______________________________________________________________________
1290 KEY OFF
1300 CLR = (VAL(RIGHT$(TIME$,2)) MOD 6) + 9
1310 COLOR CLR,0
1320 STARTROW = 5
1330 STARTCOL = 10
1340 REM ______________________________________________________________________
1350 COLOR 15,0
1360 LOCATE  7,18 : PRINT "FISHERIES POPULATION and STATISTICAL PACKAGE "
1370 COLOR CLR,0
1380 LOCATE  9,22 : PRINT "POPULATION ESTIMATE PROGRAM (FPSP-3)"
1390 LOCATE 10,30 : PRINT "Interactive  Version"
1400 COLOR 15,0
1410 LOCATE 12,38 : PRINT "by"
1420 LOCATE 14,30 : PRINT "John S. Van Deventer"
1430 LOCATE 15,30 : PRINT "USDA  Forest Service"
1440 LOCATE 16,30 : PRINT "Forestry Science Lab"
1450 LOCATE 17,30 : PRINT "316 E. Myrtle Street"
1460 LOCATE 18,30 : PRINT "Boise, Idaho   83702"
1470 LOCATE 24,70 : INPUT "Hit ENTER ", DUMMY$
1480 DIM EXPNUMFISH(12),NUMFISHPRRMVL(12)
1490 COLOR 7,0
1500 CLS
1510 INPUT "Enter the name of the STREAM.  ",STREAM$
```

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APPENDIX B: (Con.)

```
1520 INPUT "Enter the name of the SPECIES.  ",SPECIES$
1530 INPUT "Enter the number of REMOVALS (electrofishing passes). ",NUMOFRMVLS
1540 T=NUMOFRMVLS
1550 FOR RMVL = 1 TO NUMOFRMVLS
1560     PRINT "How many fish caught in pass";RMVL;
1570     INPUT NUMFISHPRRMVL(RMVL)
1580     S=S+NUMFISHPRRMVL(RMVL)
1590     C=C+NUMFISHPRRMVL(RMVL)*RMVL
1600 NEXT RMVL
1610 PRINT
1620 PRINT
1630 PRINT "Processing..."
1640 PRINT
1650 PRINT
1660 REM ..................................................................
1670 FIRSTTERM = 0
1680 I = 0
1690 THETA = 0
1700 OLDTHETA = 0
1710 PHAT = S/C
1720 GOTO 1780
1730 I = I + 1
1740 IF (S + I) > (5 * S)  THEN WARNINGMSG = 1 : GOTO 1810
1750 PHAT = S/(C+T*I)
1760 FIRSTTERM = FIRSTTERM+LOG(1+S/I)
1770 OLDTHETA = THETA
1780 THETA = FIRSTTERM+S*LOG(PHAT)+(C-S+T*I)*LOG(1-PHAT)
1790 IF (OLDTHETA<THETA) OR (I=0) THEN 1730
1800 REM ..................................................................
1810 POPEST = I-1+S
1820 CAPTPROB = S/(C+T*(I-1))
1830 PHAT = CAPTPROB
1840 POPSIZVAR=POPEST*(1-PHAT)^T*(1-(1-PHAT)^T)/((1-(1-PHAT)^T)^2-(T*PHAT)^2*(1-PHA
-1))
1850 SEPOPSIZ = SQR(POPSIZVAR)
1860 TVALUE = 1.96
1870 CONFINTPOP = TVALUE*SEPOPSIZ
1880 UPCONFINTPOP = POPEST+CONFINTPOP
1890 LOCONFINTPOP = POPEST - CONFINTPOP
1900 IF LOCONFINTPOP<S THEN LOCONFINTPOP = S
1910 REM ..................................................................
1920 VARCAPTPROB=(CAPTPROB/POPEST)^2*(POPSIZVAR/(1-CAPTPROB)^(T-1))
1930 SECAPTPROB = SQR(VARCAPTPROB)
1940 CONFINTCAPT = TVALUE*SECAPTPROB
1950 UPCONFINTCAPT = CAPTPROB + CONFINTCAPT
1960 LOCONFINTCAPT = CAPTPROB - CONFINTCAPT
1970 IF LOCONFINTCAPT < 0 THEN LOCONFINTCAPT = 0
1980 REM ..................................................................
1990 EXPTOTNUMFISH = TOTNUMFISHCOT = CHISQSUMTERM = 0
2000 FOR RMVL = 1 TO NUMOFRMVLS
2010     EXPNUMFISH(RMVL)= POPEST*(1-CAPTPROB)^(RMVL-1)*CAPTPROB
2020     CHISQSUMTERM=CHISQSUMTERM+(NUMFISHPRRMVL(RMVL)-EXPNUMFISH(RMVL))^2/EXPNUMF
MVL)
```

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APPENDIX B: (Con.)

```
2030 EXPTOTNUMFISH=EXPTOTNUMFISH+EXPNUMFISH(RMVL)
2040     TOTNUMFISHCOT = TOTNUMFISHCOT + NUMFISHPRRMVL(RMVL)
2050 NEXT RMVL
2060 CHISQUARE = CHISQSUMTERM+(TOTNUMFISHCOT-EXPTOTNUMFISH)^2/EXPTOTNUMFISH
2070 REM .....................................................................
2080 DEVICE$ = "SCRN:"
2090 OPEN DEVICE$ FOR OUTPUT AS #1
2100 IF WARNINGMSG = 1  THEN 2120  ELSE 2160
2110     PRINT #1, " "
2120     PRINT #1, "Run terminated at population estimate equal to 5 times the"
2130     PRINT #1, "total catch.  Cause:  irregular or non-descending removal"
2140     PRINT #1, "pattern.  Results should not be considered reliable."
2150     PRINT #1, " "
2160 PRINT #1, "STREAM:  " STREAM$ ;
2170 PRINT #1, TAB(45) "SPECIES:  " SPECIES$
2180 PRINT #1, " "
2190 PRINT #1, "TOTAL CATCH       = ";
2200 PRINT #1, USING "######,"; S
2210 PRINT #1, "POPULATION EST    = ";
2220 PRINT #1, USING "######,"; POPEST;
2230 PRINT #1, TAB(45) "CAPTURE PROB      = ";
2240 PRINT #1, USING "#.####"; CAPTPROB
2250 PRINT #1, "POP EST STD ERR   = ";
2260 PRINT #1, USING "###.###"; SEPOPSIZ;
2270 PRINT #1, TAB(45) "CAPT PROB STD ERR = ";
2280 PRINT #1, USING "#.####"; SECAPTPROB
2290 PRINT #1, "LOWER CONF INTRVL = ";
2300 PRINT #1, USING "######,.##"; LOCONFINTPOP;
2310 PRINT #1, TAB(45) "LOWER CONF INTRVL = ";
2320 PRINT #1, USING "#.####"; LOCONFINTCAPT
2330 PRINT #1, "UPPER CONF INTRVL = ";
2340 PRINT #1, USING "######,.##"; UPCONFINTPOP;
2350 PRINT #1, TAB(45) "UPPER CONF INTRVL = ";
2360 PRINT #1, USING "#.####"; UPCONFINTCAPT
2370 PRINT #1, " "
2380 PRINT #1, "CHI SQUARE        = ";
2390 PRINT #1, USING "####.####"; CHISQUARE
2400 PRINT #1, "REMOVAL PATTERN:  ";
2410 FOR RMVL = 1 TO NUMOFRMVLS
2420     PRINT #1, NUMFISHPRRMVL(RMVL);
2430 NEXT RMVL
2440 PRINT #1, " "
2450 PRINT #1, " "
2460 PRINT #1, " "
2470 PRINT #1, " "
2480 CLOSE #1
2490 IF PRINTFLAG = 1 THEN 2560
2500     INPUT "Do you want this PRINTED"; ANS$
2510     ANS$ = LEFT$(ANS$,1)
2520     IF ANS$ = "Y" OR ANS$ = "y"  THEN 2530  ELSE 2560
2530         PRINTFLAG = 1
2540         DEVICE$ = "LPT1:"
2550         GOTO 2090
2560 END
```

APPENDIX C: EXAMPLES OF EXECUTIONS OF THE FPSP INTERACTIVE VERSION PROGRAM

```
STREAM:  Clearwater Creek                      SPECIES:  Rainbow Trout

TOTAL CATCH        =   1,259
POPULATION EST     =   1,542                   CAPTURE PROB        = 0.4315
POP EST STD ERR    =  43.074                   CAPT PROB STD ERR = 0.0212
LOWER CONF INTRVL =   1,457.58                 LOWER CONF INTRVL = 0.3899
UPPER CONF INTRVL =   1,626.42                 UPPER CONF INTRVL = 0.4730

CHI SQUARE         =    2.9691
REMOVAL PATTERN:   678  352  229


STREAM:  So. Fork Salmon River                 SPECIES:  Chinook

TOTAL CATCH        =   1,924
POPULATION EST     =   1,970                   CAPTURE PROB        = 0.5270
POP EST STD ERR    =   8.672                   CAPT PROB STD ERR = 0.0104
LOWER CONF INTRVL =   1,953.00                 LOWER CONF INTRVL = 0.5067
UPPER CONF INTRVL =   1,987.00                 UPPER CONF INTRVL = 0.5473

CHI SQUARE         =    1.0463
REMOVAL PATTERN:   1029  502  231  115  47

STREAM:  Payette River                         SPECIES:  Cutthroat Trout

TOTAL CATCH        =   1,083
POPULATION EST     =   1,243                   CAPTURE PROB        = 0.4007
POP EST STD ERR    =  26.063                   CAPT PROB STD ERR = 0.0181
LOWER CONF INTRVL =   1,191.92                 LOWER CONF INTRVL = 0.3652
UPPER CONF INTRVL =   1,294.08                 UPPER CONF INTRVL = 0.4362

CHI SQUARE         =    2.3599
REMOVAL PATTERN:   486  311  189  97
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